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JUNG, UNSU

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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|------------------------------|--------------------------------------|-------------------------------------|--|
| Office Action Summary | Application No. 10/809,318 | Applicant(s) DENES ET AL. | |
| | Examiner UNSU JUNG | Art Unit 1641 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 December 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17, 34 and 35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17, 34 and 35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 January 2007 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114.

Applicant's submission filed on December 23, 2008 has been entered. The submission included amendments to claim 9 and addition of claims 34 and 35.

Priority

2. The instant application has a filing date of March 24, 2004 and does not claim for the benefit of a prior-filed application.

Status of Claims

3. Claims 1-17, 34, and 35 are pending and currently under consideration for patentability under 37 CFR 1.104.

Rejections Withdrawn

4. The following rejections have been withdrawn in view of amended claim 9 in the reply filed on December 23, 2008:

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- Rejection of claims 9 and 10 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et al. (U.S. Patent No. 4,822,681, April 18, 1989), and further in view of Laibinis et al. (WO 01/83826 A2, Nov. 8, 2001);
- Rejection of claim 9 on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 19-22 of copending Application No. 11/609,045 in view of Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) and Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002); and
- Rejection of claim 10 on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 19-22 of copending Application No. 11/609,045 in view of Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) and Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002), and further in view of Laibinis et al. (WO 01/83826 A2, Nov. 8, 2001).

New Grounds of Rejections

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining

obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1-8, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002)

in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et al. (U.S. Patent No. 4,822,681, April 18, 1989).

Wagner et al. teaches methods and devices for parallel, *in vitro* screening of biomolecular activity using miniaturized microfabricated devices (see entire document). The biomolecules immobilized on the surface of the devices include proteins (Abstract) and polynucleotides (oligonucleotide, p3, paragraph [0039]). The reactive site of the device may comprise a coating between a substrate and its organic thin film. This coating can be formed on the substrate by plasma exposure, which can be used directly to activate the substrate to expose polar functionalities such as hydroxyl groups (step (a), p8, paragraph [0092]) and the substrate may be either organic or inorganic and may comprise a material selected from a group consisting of silicon silica, quartz, glass, carbon, titanium dioxide, etc. (p6, paragraph [0075]). Deposition or formation of the coating on the substrate must occur prior to the formation of organic thin films (p8, paragraph [0097]). A variety of different organic thin films are suitable including molecules of the formula X-R-Y where R is a spacer, X is a functional group that binds R to the surface, and Y is a functional group for binding proteins onto the monolayer (p8, paragraph [0099]). X group may be chosen as any group, which affords chemisorption or physisorption of the monolayer onto the surface of the substrate (p9, paragraph [0103]). Methods for the formation of organic thin films include *in situ* growth from the surface, deposition by physisorption, spin-coating, chemisorption, self-assembly, or plasma-initiated polymerization from gas phase [p8, paragraph [0099]].

With respect to claim 2, Wagner et al. teaches a method further comprising immobilizing biomolecules on the surface by reacting the biomolecules with surface-bound spacer chains (p9, paragraph [0112]).

With respect to claim 3, Wagner et al. teaches a method, wherein the biomolecules are amine-functionalized or amine-containing biomolecules (p12, paragraph [0135]).

With respect to claim 4, Wagner et al. teaches a method, wherein the oxide surface comprises a silicon oxide (p6, paragraph [0075] and p9, paragraph [0104]).

With respect to claim 5, Wagner et al. teaches a method, wherein the oxide surface comprises silica, glass, or quartz (p6, paragraph [0075]).

With respect to claim 6, Wagner et al. teaches a method, wherein the oxide surface comprises a metal oxide (p6, paragraph [0075]).

With respect to claim 7, the current specification teaches that native oxides of stainless steel include chromium oxide and iron oxide (p18, paragraph [0060]). Wagner et al. teaches a method, wherein the metal oxide comprises chromium and iron oxides (p8, paragraph [0093]). Since Wagner et al. teaches that multiple interlayers may be used together (p4, paragraph [0057]), the substrate of Wagner combined with an interlayer of metal oxide comprising chromium oxide or iron oxide is interpreted as being the “native oxide of stainless steel” as the currently recited substrate.

With respect to claim 13, Wagner et al. teaches a method, wherein the biomolecule is oligonucleotides (p3, paragraph [0039]).

With respect to claim 14, Wagner et al. teaches a method, wherein the biomolecule is a protein (p3, paragraph [0038]).

However, Wagner et al. fails to teach a step of reacting a first gas comprising epoxy-functional molecules with the surface hydroxyl groups *in situ* in the absence of plasma to provide surface-bound spacer chains.

Hubbell et al. teaches that functional groups such as epoxy can interact with amine, hydroxyl, or thiol groups (see entire document, particularly p6, paragraph [0058]).

Schössler et al. teaches a method of reacting hydroxyl-group-containing solid body surfaces with glycidoxypolytriethoxysilane (see entire document, particularly column 4, lines 26-29). With this variation, the biological materials to be bound react directly with the epoxy-groups of the solid body surface (column 4, lines 29-31).

Herewith it is important that the reaction with the organosilanes, which are non-toxic and are produced to a considerable extent on a large scale, be effected by simple contact or immersion, with the activation taking place in a swollen or non-swollen state of the solid body, or even in the gaseous phase (column 4, lines 31-36). It is of greater importance herewith that the reaction with organosilanes can follow in liquid phase with organic solvents, such as acetone, toluene, dioxane, methanol, ethanol, among others, solvent mixtures such as methanol/ethanol, as well as in an aqueous milieu or water/solvent mixtures, such as methanol/water or ethanol/water, so that in contrast to many other activation techniques, the technological expenditure is lower (column 4, lines 36-44). It is particularly advantageous to effect the activation in gaseous phase through

employment of aerosols or by means of underpressure (column 4, lines 44-47). It is, moreover, advantageous that through the choice of different organosilanes and, if necessary, bifunctional coupling reagents, practically all imaginable reaction possibilities can be realized, since by utilization of the basic principle according to the present invention, solid body surfaces are obtained with the most various functional groups (column 4, lines 44-54).

Therefore, one of ordinary skill in the art at the time of the invention would have been motivated to include in the method of Wagner et al. with a spacer molecule X-R-Y, wherein X is an epoxy functional group as taught by Hubbell et al., in order to bind the spacer molecule the hydroxyl groups of the substrate surface of Wagner et al. with a reasonable expectation of success since Wagner et al. teaches that the X group may be chosen as any group, which affords chemisorption or physisorption of the monolayer onto the surface of the substrate.

Further, one of ordinary skill in the art at the time of the invention would have been motivated to select epoxy functional group of Schössler et al. as the Y in the spacer molecule X-R-Y of Wagner et al. since Schössler et al. teaches that biological materials including proteins can be bound to a solid body surface via reacting with epoxy functional groups on the solid surface.

Moreover, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to select an appropriate functional groups (X and Y) of the spacer molecule X-R-Y, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended

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use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Because the claimed spacer molecule is known in the prior art and has been disclosed as being capable of reacting with a surface of a substrate and biomolecules to immobilize biomolecules to the substrate surface in general, the selection of a specific type of functional groups in the spacer molecule in itself does not present a novel feature of the claimed invention. Since one of ordinary skill in the art at the time of the invention would recognize that the spacer molecules of Wagner et al. can have a variety of functional groups suitable to react with respective substrate surface and biomolecules, it would have been obvious to select epoxy functional group as both X and Y since Hubbell et al. teaches that epoxy functional group can interact with hydroxyl groups and Schössler et al. teaches that biological materials including proteins can be bound to a solid body surface via reacting with epoxy functional groups on the solid surface.

In addition, it would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to employ a method of reacting a gas comprising spacer molecules with epoxy functional groups with the surface hydroxyl groups of Wagner et al. in view of Hubbell et al. and Schössler et al. *in situ* in the absence of plasma since Schössler et al. teaches that activation in gaseous phase through employment of aerosols or by means of underpressure provides an activation technique, which has lower expenditure compared to other activation techniques. The advantage of employing an activation technique with lower cost provides the motivation for combining the teachings of Wagner et al., Hubbell et al., and Schössler et al. with a reasonable expectation of success because Wagner et al. teaches that monolayer can be formed

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comprising spacer molecules in gaseous phase and the gaseous phase reaction of Schössler et al. can employ variety of different bifunctional coupling reagents (i.e. spacer molecules X-R-Y) chosen to obtain solid body surfaces with appropriate functional groups.

With respect to claim 8, Wagner et al. fails to specifically teach a method, wherein the plasma is formed from a source gas comprising water, oxygen, or a mixture thereof. Hubbell et al. teaches a method, wherein the plasma is formed from a source of gas comprising water in order to increase the number of hydroxyl groups at the oxide surface (p14, paragraph [212]), wherein the oxide surface includes stainless steel (p12, paragraph [0178]). Therefore, it would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to include the plasma formed on the native oxide of stainless steel from a source of gas comprising water as taught by Hubbell et al. in the method of Wagner et al. in order to form hydroxyl groups on metal oxides. The advantage of increasing the number of hydroxyl groups at the oxide surface of Wagner et al. provides the motivation to employ the method of Hubbell et al., in which plasma is formed from a source of gas comprising water at the oxide surface of Wagner et al. with a reasonable expectation of success.

9. Claims 9, 10, 34, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et al. (U.S. Patent No. 4,822,681, April 18, 1989) as applied to claim 1 above,

and further in view of Laibinis et al. (WO 01/83826 A2, Nov. 8, 2001), Musser (U.S. Patent No. 2,559,986, July 10, 1951), and Material Safety Data Sheet for epichlorohydrin (see p6, *Ecological Information* section of MSDS Number: E0925, Jan. 1, 1996, Mallinckrodt Baker, Inc., Phillipsburg, NJ, pp1-9).

Wagner et al. in view of Hubbell et al. and Schössler et al. teaches a method of treating a surface of a substrate as set forth above. Schössler et al. further teaches that an evacuation step in a vacuum is conducted to remove excess reagent from the functionalized surface (column 7, lines 10-19).

With respect to claim 34, Schössler et al. teaches additional step of immobilizing biomolecules on the oxide surface by reacting biomolecules with the oxide surface-bound spacer chains (Abstract).

However, Wagner et al. in view of Hubbell et al. and Schössler et al. fails to teach a method, wherein the epoxy-functional molecules are epichlorohydrin molecules.

Laibinis et al. teaches that epichlorohydrin reacts with the hydroxyl moiety of a glass (substrate surface) to provide a surface having epoxide functional groups (see entire document, particularly p19, lines 14-17).

Musser teaches a method of reacting hydroxyl groups with epichlorohydrin in gaseous phase (column 5, lines 2-15).

In addition, it is well known in the art that the epichlorohydrin molecules can interact with hydroxyl radicals when exposed to air and results in degradation as evidenced by Material Safety Data Sheet (MSDS) for epichlorohydrin (see p6,

Ecological Information section of MSDS Number: E0925, Jan. 1, 1996, Mallinckrodt Baker, Inc., Phillipsburg, NJ, pp1-9).

Therefore, it would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to employ epichlorohydrin, which contains epoxy functional groups, as taught by Laibinis et al. in the method of Wagner et al. in view of Hubbell et al. and Schössler et al. in order to react with hydroxyl groups of oxide surface. The advantage of providing a surface having epoxy functional groups, which can be used to immobilize biological molecules, provides the motivation to combine the teachings of Laibinis et al. and Wagner et al. in view of Hubbell et al. and Schössler et al. with a reasonable expectation of success as epoxy functional groups of epichlorohydrin can be used to react with hydroxyl groups of the oxide surface to functionalize the surface for immobilizing biomolecules. In addition, one of ordinary skill in the art would have had a reasonable expectation of success in performing the reaction of hydroxyl groups and epichlorohydrin in a gaseous phase as Musser teaches a method of reacting hydroxyl groups with epichlorohydrin in gaseous phase. Moreover, one of ordinary skill in the art would have been motivated to perform the reaction of hydroxyl groups and epichlorohydrin in a vacuum (i.e. a volume of space that is essentially empty of matter, such that its gaseous pressure is much less than atmospheric pressure) since MSDS teaches that epichlorohydrin degrades upon exposure to air and vacuum environment would maintain minimum exposure to prevent epichlorohydrin degradation.

Further, it would have been obvious to one having ordinary skill in the art at the time of the invention to select an appropriate spacer molecule X-R-Y, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Because the claimed spacer molecule is known in the prior art and has been disclosed as being capable of reacting with a surface of a substrate and biomolecules to immobilize biomolecules to the substrate surface in general, the selection of a specific type of the spacer molecule in itself does not present a novel feature of the claimed invention. Since one of ordinary skill in the art at the time of the invention would recognize that the spacer molecules of Wagner et al. in view of Hubbell et al. and Schössler et al. can be variety of different molecules suitable to react with respective substrate surface and biomolecules, it would have been obvious to select epichlorohydrin of Laibinis et al. as the spacer molecule because Laibinis et al. teaches that epichlorohydrin reacts with hydroxyl moiety of a glass (substrate surface) to provide a surface having epoxide functional groups.

With respect to claim 35, Wagner et al. teaches a method of reacting organic thin films on top of another organic thin film (i.e. extending spacer chains, p8, paragraph [0099]). Therefore, it would have been *prima facie* obvious to one of ordinary skill in the art would to further extend the spacer chains formed with epoxide functional groups by reacting using the method of Schössler et al. (i.e. another a gas comprising spacer molecules with appropriate functional groups *in situ* in the absence of plasma) since

coating method of Schössler et al. has the advantage of employing an activation technique with lower cost provides the motivation as set forth above.

10. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et al. (U.S. Patent No. 4,822,681, April 18, 1989) as applied to claim 1 above, and further in view of Devoe et al. (WO 01/96452 A2, Dec. 20, 2001).

Wagner et al. in view of Hubbell et al. and Schössler et al. teaches a method of treating a surface of a substrate as set forth above. However, Wagner et al. in view of Hubbell et al. and Schössler et al. fails to teach a method, wherein the epoxy-functional molecules are 1,4-butanediol diglycidyl ether molecules.

Devoe et al. teaches that numerous commercially available epoxy resins including 1,4-butanediol diglycidyl ether can be used apply on a solid surface (see entire document, particularly Abstract and p13, line 12).

Therefore, it would have been obvious matter of design choice to modify the method of Wagner et al. in view of Hubbell et al. and Schössler et al. to include 1,4-butanediol diglycidyl ether of Devoe et al. as epoxy-functional molecules, since Applicant has not disclosed that 1,4-butanediol diglycidyl ether does not solve any stated problem or is for any particular purpose and it appears that using 1,4-butanediol diglycidyl ether would provide a functionalized substrate surface for immobilization of biomolecules with a reasonable expectation of success as epoxy functional groups of

1,4-butanediol diglycidyl ether can be used to react with hydroxyl groups of the oxide surface to functionalize the surface for immobilizing biomolecules.

Further, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to select an appropriate spacer molecule X-R-Y, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Because the claimed spacer molecule is known in the prior art and has been disclosed as being capable of reacting with a surface of a substrate and biomolecules to immobilize biomolecules to the substrate surface in general, the selection of a specific type of the spacer molecule in itself does not present a novel feature of the claimed invention. Since one of ordinary skill in the art at the time of the invention would recognize that the spacer molecules of Wagner et al. in view of Hubbell et al. and Schössler et al. can be variety of different molecules suitable to react with respective substrate surface and biomolecules, it would have been obvious to select 1,4-butanediol diglycidyl ether of Devoe et al. as the spacer molecule since 1,4-butanediol diglycidyl ether of Devoe et al. includes epoxy functional groups that can react with hydroxyl moiety of a substrate surface.

11. Claims 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. Patent No. PG Pub. No. US 2002/0110932, Aug. 15, 2002) in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et

al. (U.S. Patent No. 4,822,681, April 18, 1989) as applied to claim 1 above, and further in view of Dang et al. (U.S. PG Pub. No. 2003/0113478, Filed Dec. 12, 2001).

Wagner et al. in view of Hubbell et al. and Schössler et al. teaches a method of treating a surface of a substrate for immobilization of biomolecules as set forth in item 7 above. However, Wagner et al. in view of Hubbell et al. and Schössler et al. fails to teach a method, further comprising extending the spacer chains by reacting the spacer chains with gas-phase spacer molecules in situ in the absence of plasma to provide extended spacer chains, wherein the spacer molecules comprise an amine group capable of reacting with epoxy functionality of the spacer chains.

Dang et al. teaches a method of forming a coating on a substrate with a surface-modifying group, which can further react with a biologically active component resulting in a substrate with an immobilized bioactive agents such as nucleic acids and proteins (see entire document, particularly p2, paragraph [0026] and p6, paragraph [0084]). Dang et al. further teaches that it may be desirable to place one or more additional compounds as a multi-functional linker between chemically functional groups and bioactive agents to increase space between the substrate layer and the bioactive agents or to reduce undesirable responses such as steric hindrances between the functional group and the immobilized bioactive/biocompatible agents, which may limit the approach of the bioactive/biocompatible agent to the functional group, and physical bulk, electrostatic repulsion, or inappropriate positioning of the bioactive/biocompatible agent or agents, which may also contribute to reduced efficiency of the immobilized bioactive/biocompatible agent or agents (p5, paragraph [0077]). Suitable compounds

for use as multi-functional linkers include epoxies and amines and can be heterofunctional or homofunctional (p5, paragraph [0078]). The available functional groups or surface-modifying groups are used to covalently or non-covalently bind the bioactive agent possessing desirable properties to substrate (p5, paragraph [0080]).

Therefore, it would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to employ an additional spacer molecule (X-R-Y) as taught by Dang et al. in the method of Wagner et al. in view of Hubbell et al. and Schössler et al., in which reacting a gas comprising spacer molecules with the oxide surface in situ in the absence of plasma, in order to further coat the oxide surface to increase space between the substrate layer and the bioactive agents or to reduce undesirable responses and immobilize bioactive agents such as nucleic acids and proteins via covalently interaction with surface-modifying groups, wherein the functional group of the additional spacer molecule includes amine group as Hubbell et al. teaches that functional groups such as epoxy can interact with amine groups. The advantage of reducing undesirable responses such as steric hindrances between the functional group and the immobilized bioactive/biocompatible agents, which may limit the approach of the bioactive/biocompatible agent to the functional group, and physical bulk, electrostatic repulsion, or inappropriate positioning of the bioactive/biocompatible agent or agents, which may also contribute to reduced efficiency of the immobilized bioactive/biocompatible agent or agents, provides the motivation to combine the teachings of Dang et al. and Wagner et al. in view of Hubbell et al. and Schössler et al. with a reasonable expectation of success as one of ordinary skill in the art would

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recognize that additional spacer molecules would provide more efficient immobilization of biomolecules to the functionalized surface of the substrate.

New Grounds of Rejection

Double Patenting

12. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

13. Copending Application No. 11/609,045

A. Claims 1 and 4-8 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 19-22 of copending Application No. 11/609,045 in view of Wagner et al. (U.S. PG Pub.

No. US 2002/0110932, Aug. 15, 2002) and Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002).

The copending Application recites a method of treating a surface of a substrate, the method comprising:

- forming active sites on the substrate surface by exposing the substrate surface to a plasma; and
- reacting epoxy groups on gas-phase epoxy functional molecules with the surface active sites in situ in the absence of plasma to provide epoxy-terminated surface bound spacer chains (linker molecules).

However, the copending Application fails to recite a method, wherein the active sites on the substrate are hydroxyl groups and the surface is an oxide surface.

Wagner et al. teaches a method, in which a coating can be formed on a substrate by plasma exposure, which can be used directly to activate the substrate to expose polar functionalities such as hydroxyl groups (step (a), p8, paragraph [0092]) and the substrate may be either organic or inorganic and may comprise a material selected from a group consisting of silicon silica, quartz, glass, carbon, titanium dioxide, etc. (p6, paragraph [0075]) as set forth in item 7 above.

Hubbell et al. teaches that functional groups such as epoxy can interact with amine, hydroxyl, or thiol groups as set forth in item 7 above.

Therefore, one of ordinary skill in the art at the time of the invention would have been motivated to employ the method of forming hydroxyl groups on an oxide substrate surface by exposing the substrate surface to a plasma as taught by Wagner et al. in the method of the copending Application with a reasonable expectation of success since Hubbell et al. teaches that epoxy functional groups interact with hydroxyl groups.

This is a provisional obviousness-type double patenting rejection.

B. Claim 9, 10, 34, and 35 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 19-22 of copending Application No. 11/609,045 in view of Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) and Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) as applied to claims 1 and 9 above, and further in view of Laibinis et al. (WO 01/83826 A2, Nov. 8, 2001), Musser (U.S. Patent No. 2,559,986, July 10, 1951), and Material Safety Data Sheet for epichlorohydrin (see p6, Ecological Information section of MSDS Number: E0925, Jan. 1, 1996, Mallinckrodt Baker, Inc., Phillipsburg, NJ, pp1-9).

The copending Application in view of Wagner et al. and Hubbell et al. recites a method of treating a surface of a substrate as set forth above. However, copending Application in view of Wagner et al. and Hubbell et al. fails to recite a method, wherein the epichlorohydrin molecules are epichlorohydrin

molecules and an additional step of exposing the functionalized surface to vacuum *in situ* to provide epoxy-terminated, surface-bound spacer chains.

Laibinis et al. teaches that epichlorohydrin reacts with hydroxyl moiety of a glass (substrate surface) to provide a surface having epoxide functional groups as set forth above.

Musser teaches a method of reacting hydroxyl groups with epichlorohydrin in gaseous phase as set forth above.

In addition, it is well known in the art that the epichlorohydrin molecules can interact with hydroxyl radicals when exposed to air and results in degradation as evidenced by Material Safety Data Sheet (MSDS) for epichlorohydrin as set forth above.

Therefore, one of ordinary skill in the art at the time of the invention would have been motivated to employ epichlorohydrin, which contains epoxy functional groups, as taught by Laibinis et al. in the method of the copending Application in view of Wagner et al. and Hubbell et al. with a reasonable expectation of success since Laibinis et al. teaches that epichlorohydrin reacts with hydroxyl moiety.

In addition, one of ordinary skill in the art would have had a reasonable expectation of success in performing the reaction of hydroxyl groups and epichlorohydrin in a gaseous phase as Musser teaches a method of reacting hydroxyl groups with epichlorohydrin in gaseous phase.

Moreover, one of ordinary skill in the art would have been motivated to perform the reaction of hydroxyl groups and epichlorohydrin in a vacuum (i.e. a

volume of space that is essentially empty of matter, such that its gaseous pressure is much less than atmospheric pressure) since MSDS teaches that epichlorohydrin degrades upon exposure to air and vacuum environment would maintain minimum exposure to prevent epichlorohydrin degradation.

Further, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to select an epichlorohydrin as a epihalohydrin molecule, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Because the claimed epihalohydrin molecule is known in the prior art and has been disclosed as being capable of reacting with the hydroxyl group on the substrate surface in general, the selection of a specific type of the epihalohydrin molecule in itself does not present a novel feature of the claimed invention. Since one of ordinary skill in the art at the time of the invention would recognize that the epihalohydrin molecule of the copending Application in view of Wagner et al. and Hubbell et al. can include of different halogens with epoxy functional groups, it would have been obvious to select epichlorohydrin of Laibinis et al. as the epihalohydrin molecule because Laibinis et al. teaches that epichlorohydrin reacts with hydroxyl moiety of a glass (substrate surface) to provide a surface having epoxide functional groups.

With respect to claim 35, Wagner et al. teaches a method of reacting organic thin films on top of another organic thin film (i.e. extending spacer chains,

p8, paragraph [0099]). Therefore, it would have been prima facie obvious to one of ordinary skill in the art would to further extend the spacer chains formed with epoxide functional groups by reacting using the method of Schössler et al. (i.e. another a gas comprising spacer molecules with appropriate functional groups *in situ* in the absence of plasma) since coating method of Schössler et al. has the advantage of employing an activation technique with lower cost provides the motivation as set forth above.

This is a provisional obviousness-type double patenting rejection.

C. Claims 11 and 12 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 19-22 of copending Application No. 11/609,045 in view of Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) and Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) as applied to claim 1 above, and further in view of Devoe et al. (WO 01/96452 A2, Dec. 20, 2001).

The copending Application in view of Wagner et al. and Hubbell et al. recites a method of treating a surface of a substrate as set forth in item 12A above. However, copending Application in view of Wagner et al. and Hubbell et al. fails to recite a method, wherein the epoxy-functional molecules are 1,4-butanediol diglycidyl ether molecules.

Devoe et al. teaches that numerous commercially available epoxy resins including 1,4-butanediol diglycidyl ether can be used apply on a solid surface (see entire document, particularly Abstract and p13, line 12).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to select an epoxy-functional molecule such as 1,4-butanediol diglycidyl ether of Devoe et al., since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Because the claimed epoxy-functional molecule, 1,4-butanediol diglycidyl ether, is known in the prior art and has been disclosed as being capable of reacting with a surface of a substrate in general, the selection of a specific type of the epoxy-functional molecule in itself does not present a novel feature of the claimed invention. Since one of ordinary skill in the art at the time of the invention would recognize that the epoxy-functional molecule of the copending Application in view of Wagner et al. and Hubbell et al. can be variety of different molecules suitable to react with the substrate surface, it would have been obvious to select 1,4-butanediol diglycidyl ether of Devoe et al. as the spacer molecule since 1,4-butanediol diglycidyl ether of Devoe et al. includes epoxy functional groups that can react with hydroxyl moiety of a substrate surface.

This is a provisional obviousness-type double patenting rejection.

Response to Arguments

14. Rejection of claims 1-8, 13, and 14 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al.

Applicant's arguments filed on December 23, 2008 have been fully considered but they are not persuasive essentially for the reasons of record and arguments addressed herein.

Applicant's arguments that none of the prior art references discloses a gas-phase reaction between an epoxy group on an epoxy-functional molecule and a surface bound-hydroxyl group have been fully considered. Applicant further specifically contend that the vague statement in Schössler et al. regarding gas-phase reactions of silane functionalities on organosilanes with hydroxyl groups to support a sweeping and general conclusions that it is possible and desirable to replace all solution-phase reactions with gas-phase reactions, regardless of reactive groups and that the advantage of carrying out the gas-phase reaction of Schössler et al. cannot be generalized to chemical systems other than organosilanes. Although it is acknowledged that Schössler et al. does teach gas-phase reactions of silane functionalities on organosilanes with hydroxyl groups, Schössler et al. does teach organosilanes containing variety of different functional groups including epoxy functional groups (column 3, lines 3-57), which is reacted with surface bound hydroxyl groups (column 3, lines 3-13). Schössler et al. further teaches that it is, moreover, advantageous that through the choice of different organosilanes and, if necessary, bifunctional coupling reagents, practically all imaginable reaction possibilities can be realized, since by utilization of the basic principle according to the present invention, solid body surfaces are obtained with the

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most various functional groups (column 4, lines 44-54). Therefore, Schössler et al. does teach a gas-phase reaction between an epoxy group on an epoxy-functional molecule and a surface bound-hydroxyl group and one of ordinary skill in the art would have had a reasonable expectation of success in performing gas-phase reactions of epoxy functionalities on organosilanes with hydroxyl groups. Further, the general conclusion that the advantages providing an activation technique, which has lower expenditure compared to other activation techniques, in the gas-phase activation method of Schössler et al. would apply to reactions of variety of different functional groups as taught by Schössler et al.

Applicant's argument that none of the prior art references teach carrying out the reaction *in situ* has been fully considered but is not found persuasive essentially for the reasons of record. As set forth in the previous Office Action dated July 23, 2008 (see item 6), Wagner et al. teaches that organic thin films can be grown *in situ*. Further, Schössler et al. teaches that surface-bound hydroxyl groups can be activated in gaseous phase. While applicant contends that the meaning of *in situ* to be "without exposing the hydroxyl groups to the atmosphere," applicant fails to provide evidence to support this definition of the term *in situ*. According to the Webster's New Collegiate Dictionary (C & G Merriam Co., Springfield, MA, 1974, p598), the term *in situ* is defined as "in the natural or original position." Since the term *in situ* is not specifically defined by the original specification to mean "without exposing the hydroxyl groups to the atmosphere," the term *in situ* has been interpreted as defined by the Webster's New Collegiate Dictionary. Therefore, both Wagner et al. and Schössler et al. teach that the

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surface-bound hydroxyl groups can be further reacted with appropriate functional groups directly on the surface (i.e. in their original position), which read on the claimed recitation of *in situ* reaction.

Taken together, the combined teachings of Wagner et al. in view of Hubbell et al. and Schössler et al. meets the limitation of “reacting epoxy groups on gas-phase epoxy-functional molecules with the surface hydroxyl groups *in situ* in the absence of plasma to provide epoxy-terminated surface bound spacer chains” currently recited in independent claim 1 and all dependent claims.

In view of the foregoing response to arguments, the rejection of claims 1-8, 13, and 14 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al. has been maintained.

15. Rejection of claims 9 and 10 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Laibinis et al.

Applicant's arguments with respect to claims 9 and 10 have been considered but are moot in view of the new ground(s) of rejection.

16. Rejection of claims 11 and 12 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Devoe et al.

Applicant's arguments filed on December 23, 2008 have been fully considered but they are not persuasive essentially for the reasons of record and response to arguments set forth above.

In view of the foregoing response to arguments, the rejection of claims 11 and 12 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Devoe et al. has been maintained.

17. Rejection of claims 15-17 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Dang et al.

Applicant's arguments filed on December 23, 2008 have been fully considered but they are not persuasive essentially for the reasons of record and response to arguments set forth above.

In view of the foregoing response to arguments, the rejection of claims 15-17 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Dang et al. has been maintained.

18. Provisional Double Patenting Rejections

All the provisional double patenting rejections set forth above been maintained in view of absence of arguments directed to the provisional double patenting rejection in the reply filed on December 23, 2008.

19. Since the prior art fulfills all the limitations currently recited in the claims, the invention as currently recited would read upon the prior art.

Prior Art of Record

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20. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Lassmann et al. (U.S. Patent No. 4,280,824, July 28, 1981) teaches that a vacuum pump can be used to remove gaseous reaction product (see entire document, particularly column 4, lines 44-62).
- Gleason et al. (U.S. Patent No. 7,112,615 B2, filed July 22, 2003) teaches that a vacuum system can be used for removal of gaseous species other than those required for the reaction/deposition (see entire document, particularly column 6, lines 58-67).

Conclusion

21. No claim is allowed.

22. Any inquiry concerning this communication or earlier communications from the examiner should be directed to UNSU JUNG whose telephone number is (571)272-8506. The examiner can normally be reached on M-F: 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Shibuya can be reached on 571-272-0806. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Unsu Jung/
Unsu Jung
Primary Examiner
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